U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
NATIONAL METEOROLOGICAL CENTER

**OFFICE NOTE 84**

(REVISED)
(see overleaf)

# Packing and Identification of NMC Grid-Point Data

Automation Division Staff

February 10, 1994

Changes, additons, and corrections since the last full printing, dated January 19, 1993:

| | | |
|---|---|---|
| January 1993 | p.10 | interpretation of parameter 159 clarified |
| | p.11-13 | units of 179,199,210,211 |
| | | new parameters 219 & 220 |
| | p.27ff | new grid types: 87, 88, 89, 90, 91, 92, 93, 98, 104, 105, 106, 107; 153 deleted |
| | p.28 | RUC added to run marker table. |
| | p.29ff | new generating programs:80,81,83,84,85,86 |
| March 1993 | p.10ff | Added parameters 138, 157, 158 |
| | p.9 | Deleted parameter 118 (redundant with 157) |
| November 1993 | p.20 | Added Grid 4 |
| February 1994 | p.4 | Correction to specification of location of T |
| | p.21 | Added grid 18 (12 hex) |
| | p.30 | Model 78 (4E hex) changed to indicate 28 layers |
| | p.30.1 | Added model No. 87, 88 |

Then reprinted in entirety with new pagination, one hopes for the last time, as this identification system will not be carried over to UNIX based operating systems. GRIB will be used instead.

Note: This publication is available via **Internet** on the NOAA Information Center server.

Do an "anonymous FTP" into **nic.fb4.noaa.gov**, with a password of your e-mail address; check the /Readme file in the root directory for further directions.

## INTRODUCTION

This Office Note provides information related to NMC grid point data fields. It describes the structure and packing of the data and the system used to identify the fields. A large number of requirements have been accommodated since these procedures were introduced many years ago and, as might be expected, some exceptions have crept into usage. These generally involve a minor amount of non-conformity to the standard units and to the packing procedures. The exceptions, where known, are indicated.

The "Office Note 84" packing and identification method, as it is known locally, is an internal NMC standard; external transmissions generally use one or more World Meteorological Organization (WMO) code forms. In particular, grid-point data are represented in Code FM 92 GRIB (GRIdded Binary). Documentation on GRIB is available from the NMC Automation Division as Office Note 388. The documentation is also available on the **nic.fb4.noaa.gov** server. An effort is under way to convert NMC's internal data storage to GRIB to avoid the necessity of routinely changing data from one representation form to another and to bring NMC into line with the international standards.

## NMC PACKED BINARY DATA FORMAT

Most NMC grid point data fields are packed by transforming 32-bit full-word floating point numbers into 16-bit half-word integers using a scaling algorithm which will be described later. A 12-word label is prefixed to each packed data array, serving two purposes: 1) to uniquely identify the data field; and 2) to hold count and scaling information so that the data may be unpacked and converted back into an array of floating point numbers.

Spectral coefficients are stored without packing. In this case, each complex coefficient is composed of two 32-bit full-word floating point numbers.

## DATA PACKING AND UNPACKING

The method for scaling and packing the data is as follows.

First, compute a reference value A by finding the maximum and minimum data values, QMAX and QMIN, respectively. Use these two values to determine the mid-range of the data array:

$$A = (QMAX + QMIN) / 2.0$$

Next, find the binary scaling value n, the least integer such that:

$$(QMAX - A) < 2^{**}n$$

("**" denotes exponentiation.)

The reference value A is stored as a 32-bit IBM floating point number in word 10 of the 12-word label. The binary scaling value n is stored as a halfword integer in the right half of word 11. (See Figure 1.)

Then the data array is scaled according to:

$$H(j) = (Q(j) - A) * 2**(15 - n), \ j=1,J$$

where $Q(j)$ is a 32-bit floating point number to be packed, and $J$ is the number of data points. The scaled values $H(j)$ are rounded, converted to halfword integers, and stored in sequence following word 12 of the label. The points are taken in the order they occur in storage. Negative values of $n$ and $H(j)$ are stored in two's complement form.

NMC data fields can be packed and unpacked by this method with NMC library subroutines W3AI00 and W3AI01. The casual users of NMC packed fields need not concern themselves further with the packing details except to note that 15-bit precision is maintained. The precision retained by the scaling algorithm depends inversely on the range of values in the original array; i.e., the smaller the range, the greater the precision retained. Using a reference value which is the mid-range of the data array and forming departures from that value yields the same precision as using a reference value which is the minimum of the data array and then forming positive departures with 16-bit precision.

In packing a data field, the reference value $A$ and the scaling factor $n$ can, of course be preset by the creator of the field rather than using the packing subroutine W3AI00. This procedure affects only the precision of the data generated and does not prohibit the use of the unpacking subroutine W3AI01, as long as all 12 ID label words are properly set.

## IDENTIFYING THE DATA FIELDS

Each packed data field is uniquely identified by the first 5 words of its 12-word label. These 5 words specify the data type, the type and value of the (constant) surface on which the data are given, the forecast (projection) time (including the value zero), the grid type, and any other parameters needed. See Figure 1.

Most NMC data fields can be thought of as some quantity $Q$ on a horizontal or quasi-horizontal surface $S$ at some level of value $L$. For example, a 500-hPa height field would be identified by specifying $Q$ = height, $S$ = pressure, and $L = 500$. Another example is $Q$ = pressure, $S$ = mean sea level, and $L = 0$ (not applicable). If the quantity $Q$ is for a layer, the domain of the layer is given by $S1$ at $L1$ and $S2$ at $L2$. In this case, the surface of $S1$ is the one geometrically above the surface of S2. For example, the thickness of the 500 to 1000-hPa layer is specified by $Q$ = height, S1 and S2 = pressure, $L1 = 500$, and $L2 = 1000$. Another possibility is that the quantity $Q$ is formed by differencing two fields of the same data type, e.g., constant pressure height for different levels (thickness) or constant pressure height for the same level for different times (tendency). The identifications for these examples, as well as for many other possibilities, can be constructed by carefully considered combinations of the markers T, M, X, and N, as described in Tables 2 through 5, below.

The numerical value of the level L for the corresponding surface S is coded in words 2 and 4 of the label as follows:

Represent L as:

$$L = C * 10^{**}E$$

where C is a 5-digit signed decimal integer whose high-order digit is zero unless L is a negative number, and E is a signed integer. The convention for representing the signed integers C and E is to set the high-order bit on for negative values. For example, if L = 500:

$$C = 50000$$

$$E = -2$$

so that:

$$L = 50000 * 10^{**}(-2)$$

Again, if L = 0.83333

$$C = 83333$$

$$E = -5$$

so that:

$$L = 83333 * 10^{**}(-5)$$

## LABEL ELEMENT VALUES

Table 1 gives the code figures for Q and S, the data type and surface, both in word 1 (and possibly word 3) of the label.

Table 2 gives the values for the marker T which is used to specify time intervals. It also explains how the values of F1 and F2 are to be interpreted. T is found in word 2; F1 and F2 are in words 1 and 3 respectively.

Table 3 gives values for the marker M which is used to specify data fields involving layers, and to indicate whether fields have been initialized. M is in word 3.

Table 4 gives values to be used for the exception marker X, found in word 3, which is used to specify a data field whose date/time (YYMMDDII) precedes that of the date/time found in the data set identifier table. This option is used, for example, to store first guess fields from an earlier cycle in a current cycle data set.

Table 5 gives values for the miscellaneous marker N, which is used to specify types of spectral coefficient data and also to indicate that forecast times are in units of half-days rather than hours. N is in word 4.

Table 6 gives values for the markers CM and CD, word 5, which specify climatological data fields.

Table 7 gives values for the marker K which identifies the grid for which the data are given. K is in word 7. Table 7 lists the grids currently in operational use at NMC as well as others which have been used in the past. The grids thought to be active as of the date of this Office Note are indicated in the table with an "A".

The vertical grid lines of an NMC grid can be considered columns (i) and the horizontal grid lines can be considered rows (j). The coordinate system is the normal right-hand Cartesian system in which i increases from left to right and j increases from bottom to top. Grid point values are stored in consecutive array locations starting with the bottom row. Succeeding rows are stored in a like manner progressing from the bottom to the top of the grid. This follows the usual FORTRAN indexing procedure for a two-dimensional array.

For polar stereographic projection grids, the orientation is defined as the longitude value which parallels the vertical grid lines and for which latitude increases as j increases. This longitude may lie within or without the domain of the grid and may or may not coincide with a grid line.

Table 8 gives the values for the marker KS which identifies how the field was derived; e.g., by spectral methods, by departures from climatological normals, etc.

Values from the tables described above, used in combination with values for surfaces (C1,E1 and C2,E2) and values for forecast hours F1 and F2, are sufficient to identify a data field.

The first 4 bits of Word 6 indicate the source of the first guess for the analysis: 0 for the AVN run, 1 for the FNL run. The next 4 contain a count of number of additional physical records that constitute one (large) logical record. The physical record size and the number is set with the data set is initially allocated with VSAM I/O. If the number of physical records is likely to exceed the number of logical records (individual packed fields) because of the use of large logical records, this must be taken into account during the original allocation of the files. The remaining portions of the word are for internal (computer) use and can be ignored.

Word 7 gives the date and time of either the nominal observation time of the data used in the analysis, or the initial time of the forecast. The time II is specified in Universal Coordinated Time (UTC) in hours: 00-23 (midnight UTC II = 00, noon UTC II = 12). YY is the year of the century, 00-99, MM is the month of the year, 1-12, and DD is the day of the month, 1-31. The date and time are entered as 8-bit integers in the format YYMMDDII.

The remainder of the label should be filled out as shown in Figure 1. Most users rely upon standard NMC library subroutines to accomplish packing the data. These subroutines will also initialize words 9 and 10 and the scaling value in word 11.

The user must supply J, the number of data points, in the right-hand (low-order) side of word 8 for the packing subroutine (W3AI01). Note that there are only 16 bits available to specify the number of data points. This means that a single field is limited to no more than approximately

65,000 data points. Special versions of the packer/unpacker are available to take care of such very large records. They make use of the "reserved" word 12 to hold the data point count. Note also, for records larger that about 32,000 data points that the number of bytes in the record (word 9) will be incorrect. Generally there are approximately two times as many bytes in the record as data points; for byte counts that are too large to fit into word 9, the number will simply be truncated at the high end. Neither the packer nor the unpacker make any use of the byte count.

Table 9 gives the values of the marker R, word 8, which specifies the run within a cycle.

Table 10 gives the values for the marker G, word 8, which specifies the program which generated the field. Programs which are currently in operational use as of the date of this Office Note are indicated by an "A". Table 10, incidentally, is a concise history of operational numerical weather prediction at NMC.

Tables 9 and 10 are intended primarily for internal NMC use. The markers R and G in some data fields may have these parameters specified in a manner other than that given in this Office Note.

Table 11 contains the hexadecimal representations of some commonly used values of C. Negative values of C and E are indicated by turning on the high-order bit of these parameters, thus using sign-and-magnitude representation.

Table 12 shows examples of identifying some common data fields.

Table 13 gives the values for the marker P, word 11, which specifies the number of bits which have been used to pack each grid point value. While the most common number of bits used is 16 (for which P = 0), there are some fields which have been packed using fewer bits. In these cases, the data array is scaled according to:

$$H(j) = (Q(j) - A) * 2**((P-1) - n), \quad j=1,J$$

Table 1 - Q and S

PARAMETERS AND SURFACES

| Number Hex | Number Dec | Abbreviation (*) | Item | Units |
|---|---|---|---|---|
| | | | Height wrt mean sea level | |
| 1 | 1 | -HGT-- | Geopotential | gpm |
| 2 | 2 | -P-ALT | Pressure altitude | gpm |
| | | | Distance wrt Earth's surface | |
| 6 | 6 | -DIST- | Geometric distance above | m |
| 7 | 7 | -DEPTH | Geometric distance below | m |
| 8 | 8 | -PRES- | Atmospheric pressure | hPa |
| 9 | 9 | -PTEND | Pressure tendency | hPa/sec |
| | | | Temperature | |
| 10 | 16 | -TMP-- | Sensible air temperature | degree K |
| 11 | 17 | -DPT-- | Dewpoint temperature | degree K |
| 12 | 18 | -DEPR- | Dewpoint depression | degree K |
| 13 | 19 | -POT-- | Potential temperature | degree K |
| 14 | 20 | -T-MAX | Maximum temperature | degree K |
| 15 | 21 | -T-MIN | Minimum temperature | degree K |
| 16 | 22 | -TSOIL | Soil temperature | degree K |
| 17 | 23 | -EPOT- | Equivalent potential temp. | degree K |
| 18 | 24 | -VTMP- | Virtual temperature | degree K |
| | | | Vertical motion | |
| 28 | 40 | -V-VEL | Vertical velocity dp/dt | hPa/sec |
| 29 | 41 | -NETVD | Net vertical displacement | hPa |
| 2A | 42 | -DZDT- | Vertical velocity dz/dt | m/sec |
| 2B | 43 | -OROW- | Orographic component dz/dt | m/sec |
| 2C | 44 | -FRCVV | Frictional component dz/dt | m/sec |

Table 1 - Q and S (cont)

| Number Hex | Number Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| | | | Wind | |
| 30 | 48 | -U-GRD | U comp. of wind wrt grid | m/sec |
| 31 | 49 | -V-GRD | V comp. of wind wrt grid | m/sec |
| 32 | 50 | -WIND- | Wind speed | m/sec |
| 33 | 51 | -T-WND | Thermal wind speed | m/sec |
| 34 | 52 | -VW-SH | Vertical speed shear | 1/sec |
| 35 | 53 | -U-DIV | Divergent u comp wrt grid | m/sec |
| 36 | 54 | -V-DIV | Divergent v comp wrt grid | m/sec |
| 37 | 55 | -WDIR- | Direction from which wind is blowing (wrt North) | degree |
| 38 | 56 | -WWND- | Westerly comp. of wind | m/sec |
| 39 | 57 | -SWND- | Southerly comp. of wind | m/sec |
| 3A | 58 | -RATS- | Ratio of speeds | non-dim. |
| 3B | 59 | -VECW- | Vector wind (spectral) | m/sec |
| 3C | 60 | -SFAC- | Steadiness factor | percent |
| 3D | 61 | -GUST- | Wind gustiness | m/sec |
| 3E | 62 | D-DUDT | Diffusive u-comp. accel. | m/sec**2 |
| 3F | 63 | D-DVDT | Diffusive v-comp. accel. | m/sec**2 |
| | | | Fluid flow functions | |
| 47 | 71 | MGSTRM | Montgomery Stream Function | m**2/sec**2 |
| 48 | 72 | -ABS-V | Absolute vorticity | 1/sec |
| 49 | 73 | -REL-V | Relative vorticity | 1/sec |
| 4A | 74 | -DIV-- | Divergence | 1/sec |
| 4B | 75 | -POT-V | Potential vorticity | deg K/hPa/sec |
| 50 | 80 | -STRM- | Stream function | m**2/sec |
| 51 | 81 | -V-POT | Velocity potential | m**2/sec |
| 52 | 82 | -U-STR | Westerly comp. wind stress | N/m**2 |
| 53 | 83 | -V-STR | Southerly comp. wind stress | N/m**2 |
| 54 | 84 | -TUVRD | Westerly wind comp. acceleration by vert. diffusion | N/m**2 |
| 55 | 85 | -TVVRD | Southerly wind comp. acceleration by vert. diffusion | N/m**2 |
| 56 | 86 | XGWSTR | x-component of gravity wave drag | N/m**2 |
| 57 | 87 | YGWSTR | y-component of gravity wave drag | N/m**2 |

Table 1 - Q and S (cont)

| Number Hex | Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| | | | Moisture | |
| 58 | 88 | -R-H-- | Relative humidity | percent |
| 59 | 89 | -P-WAT | Precipitable water | kg/m**2 |
| 5A | 90 | -A-PCP | Accumulated total precip | meter |
| 5B | 91 | -P-O-P | Probability of precipitation | percent |
| 5C | 92 | -P-O-Z | Prob. of frozen precipitation | percent |
| 5D | 93 | -SNO-D | Snow depth | m |
| 5E | 94 | -ACPCP | Accumulated convective precip | m |
| 5F | 95 | -SPF-H | Specific humidity | kg/kg |
| 60 | 96 | -L-H2O | Liquid water | kg/kg |
| 61 | 97 | -RRATE | Rainfall rate | kg/m**2/sec |
| 62 | 98 | -TSTM- | Probability of thunderstorm | percent |
| 63 | 99 | -CSVR- | Conditional probability of severe local storm | percent |
| 64 | 100 | -CTDR- | Conditional probability of major tornado outbreak | percent |
| 65 | 101 | -MIXR- | Mixing ratio | kg/kg |
| 66 | 102 | -PSVR- | Unconditional probability of severe local storm | percent |
| 67 | 103 | -MCONV | Moisture convergence | kg/kg/sec |
| 68 | 104 | -VAPP- | Vapor pressure | hPa |
| 69 | 105 | -NCPCP | Accumulated non-convective precipitation | m |
| 6A | 106 | -ICEAC | Ice accretion rate | m/s |
| 6B | 107 | -NPRAT | Non-convective precip rate | kg/m**2/sec |
| 6C | 108 | -CPRAT | Convective precipitation rate | kg/m**2/sec |
| 6D | 109 | -TQDEP | Deep conv. moisture tndcy. | kg/kg/sec |
| 6E | 110 | -TQSHL | Shallow conv. moisture tndcy | kg/kg/sec |
| 6F | 111 | -TQVDF | Vertical diffusion moisture tendency | kg/kg/sec |

Table 1 - Q and S (cont)

| Number Hex | Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| | | | Stability | |
| 70 | 112 | -LFT-X | @Lifted index | degree K |
| 71 | 113 | -TOTOS | @Total totals | degree K |
| 72 | 114 | -K-X-- | @K-index | degree K |
| 73 | 115 | -C-INS | @Convective instability | degree K |
| 74 | 116 | -4LFTX | 4-layer lifted index | degree K |
| 75 | 117 | -A-EVP | Accumulated evaporation | meters |
| 77 | 119 | -CIN-- | Convective inhibition (negative buoyant energy) | m**2/sec**2 |
| | | | Wave components | |
| 78 | 120 | -L-WAV | Long wave component of geopotential | gpm |
| 79 | 121 | -S-WAV | Short wave component of geopotential | gpm |
| | | | Miscellaneous surfaces/levels | |
| 80 | 128 | -MSL-- | Mean sea level (NWS reduction) | ----- |
| 81 | 129 | -SFC-- | Earth's surface (base of atmosphere) | ----- |
| 82 | 130 | -TRO-- | Tropopause | ----- |
| 83 | 131 | -MWSL- | Maximum wind speed level | ----- |
| 84 | 132 | -PLYR- | Oceanographic primary layer | ----- |
| 85 | 133 | -A-LEV | Ship Anemometer Level (19.5m) | ----- |
| 86 | 134 | -T-AIL | Top of Aircraft Icing Layer | ----- |
| 87 | 135 | -B-AIL | Bottom of Aircraft Icing Layer | ----- |
| 88 | 136 | -MSLSA | Mean sea level (Standard Atmosphere Reduction) | ----- |
| 89 | 137 | -MSLMA | Mean sea level (MAPS System Reduction) | ----- |
| 8A | 138 | -MSLET | Mean Sea Level (ETA, Fedor Messinger reduction method) | ----- |

Table 1 - Q and S (cont)

| Number Hex | Number Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| | | | Sigma domain | |
| 90 | 144 | -BDY-- | Boundary | ---- |
| 91 | 145 | -TRS-- | Troposphere | ----- |
| 92 | 146 | -STS-- | Stratosphere | ----- |
| 93 | 147 | -QCP-- | Quiet cap | ----- |
| 94 | 148 | -SIG-- | Entire atmosphere | ----- |
| | | | Miscellaneous parameters | |
| 9D | 157 | -CAPE- | Convective Available Potential Energy | J/kg |
| 9E | 158 | -TKE-- | Turbulent Kinetic Energy | J/kg |
| 9F | 159 | -CONDP | Condensation pressure of parcel lifted from indicated level/surface (S). | hPa |
| A0 | 160 | -DRAG- | Drag coefficient approx. range: 100-1200 (on maps 5&27) 0.001-0.009 (on maps 29&30) | non-dim. |
| A1 | 161 | -LAND- | Land/sea flag values... on map 5: land=-1, sea=0; on maps 29,30,33,34: land=+1, sea=0 | non-dim. |
| A2 | 162 | -KFACT | K factors (700 hPa to 500 hPa normal ratio) | non-dim. |
| A3 | 163 | -10TSL | Conversion consts (1000 hPa to sea level pressure) | hPa/m |
| A4 | 164 | -7TSL- | Sea level pressure specification from 700 hPa heights | hPa/m |
| A5 | 165 | -RCPOP | Regression coefficients for probability of precip. | percent/m |
| A6 | 166 | -RCMT- | Regression coefficients for mean temperature | deg K/m |
| A7 | 167 | -RCMP- | Regression coefficients for mean precipitation | m(precip)/m |
| A8 | 168 | -ORTHP | Orthogonal pressure function | hPa |

Table 1 - Q and S (cont)

| Number Hex | Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| A9 | 169 | -ALBDO | Albedo<br>approx. range: 0.06 - 0.80 | non-dim. |
| AA | 170 | -ENFLX | Energy flux | watt/m**2 |
| AB | 171 | -TTHTG | Temperature tendency from heating | deg K/sec |
| AC | 172 | -ENRGY | Energy statistics | (various) |
| AD | 173 | -TOTHF | Total heat flux downward | watt/m**2 |
| AE | 174 | -SPEHF | Sensible + evaporative heat flux upward | watt/m**2 |
| AF | 175 | -SORAD | Solar heat flux downward | watt/m**2 |
| B0 | 176 | -LAT-- | Latitude | degree N |
| B1 | 177 | -LON-- | Longitude | degree W |
| B2 | 178 | -RADIC | Radar intensity | non-dim. |
| B3 | 179 | ------ | Ceiling Height (TDL) | hft@@ |
| B4 | 180 | ------ | Visibility | m |
| B5 | 181 | ------ | Liquid Precip. (Y/N) (TDL) | binary |
| B6 | 182 | ------ | Freezing Precip. (Y/N) (TDL) | binary |
| B7 | 183 | ------ | Frozen Precip. (Y/N) (TDL) | binary |
| B8 | 184 | -PROB- | Probability | percent |
| B9 | 185 | -CPROB | Conditional probability | percent |
| BA | 186 | -USTAR | Surface friction velocity | m/sec |
| BB | 187 | -TSTAR | Surface friction temperature | degree K |
| BC | 188 | -MIXHT | Mixing height | m |
| BD | 189 | -MIXLY | Number of mixed layers next to the surface | (integer) |
| | | | Radiation Parameters | |
| BE | 190 | -DLRFL | Downward flux of long-wave radiation | watt/m**2 |
| BF | 191 | -ULRFL | Upward flux of long-wave radiation | watt/m**2 |
| C0 | 192 | -DSRFL | Downward flux of short-wave radiation | watt/m**2 |
| C1 | 193 | -USRFL | Upward flux of short-wave radiation | watt/m**2 |
| C2 | 194 | -UTHFL | Upward turbulent flux of sensible heat | watt/m**2 |
| C3 | 195 | -UTWFL | Upward turbulent flux of water | kg/m**2/sec |

Table 1 - Q and S (cont)

| Number Hex | Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| C4 | 196 | -TTLWR | Temperature tendency from long-wave radiation | deg K/sec |
| C5 | 197 | -TTSWR | Temperature tendency from short-wave radiation | deg K/sec |
| C6 | 198 | -TTRAD | Temperature tendency from all radiation | deg K/sec |
| C7 | 199 | -MSTAV | Moisture availability | fractional: 1.0-0.0 |
| C8 | 200 | -RDNCE | **Radiance | watt/m**2/sr/m |
| C9 | 201 | -BRTMP | **Brightness temperature | degree K |
| CA | 202 | -TCOZ- | **Total column ozone | kg/m**2 |
| CB | 203 | -OZMR- | **Ozone mixing ratio | kg/kg |
| CC | 204 | -SWABS | Rate of absorption of short-wave radiation | watt/m**2 |
| | | | Tendency Parameters | |
| CD | 205 | -TTLRG | Temperature tendency from large scale precipitation | deg K/sec |
| CE | 206 | -TTSHL | Temperature tendency from shallow convection | deg K/sec |
| CF | 207 | -TTDEP | Temperature tendency from deep convection | deg K/sec |
| D0 | 208 | -TTVDF | Temperature tendency from vertical diffusion | deg K/sec |
| D1 | 209 | -STCOF | Soil thermal coefficient | joules/m**2/deg |
| | | | Cloud-cover variables | |
| D2 | 210 | CDLYR | Amount of non-convective cloud | fract:1.0-0.0 |
| D3 | 211 | CDCON | Amount of convective cloud | fract:1.0-0.0 |
| D4 | 212 | PBCLY | Pressure at the base of a non-convective cloud | hPa |
| D5 | 213 | PTCLY | Pressure at the top of a non-convective cloud | hPa |
| D6 | 214 | PBCON | Pressure at the base of a convective cloud | hPa |

Table 1 - Q and S (cont)

| Number Hex | Dec | Abbreviation | Item | Units |
|---|---|---|---|---|
| D7 | 215 | PTCON | Pressure at the top of a convective cloud | hPa |
| D8 | 216 | SFEXC | Exchange coefficient at surface | (kg/m**3)*m/sec |
| D9 | 217 | ZSTAR | Surface roughness length | m |
| DA | 218 | STDZG | Standard deviation of ground height | m |
| DB | 219 | | height of bottom of lowest cloud layer | hft |
| DC | 220 | | height of bottom of highest cloud layer | hft |
| | | | Oceanographic variables | |
| 130 | 304 | -UOGRD | U comp. of current wrt grid | m/sec |
| 131 | 305 | -VOGRD | V comp. of current wrt grid | m/sec |
| 180 | 384 | -WTMP- | Water temperature | degree K |
| 181 | 385 | -WVHGT | Height of wind-driven waves | m |
| 182 | 386 | -SWELL | Height of sea swells | m |
| 184 | 388 | -WVPER | Period of wind-driven waves | sec |
| 185 | 389 | -WVDIR | Direction from which waves are moving (wrt North) | degree |
| 186 | 390 | -SWPER | Period of sea swells | sec |
| 187 | 391 | -SWDIR | Direction from which swells are moving (wrt North) | degree |
| 188 | 392 | -ICWAT | Ice-free water surface | percent |
| 190 | 400 | -HTSGW | Significant wave height (combined sea and swell) | m |
| 191 | 401 | -PERPW | Primary wave period | sec |
| 192 | 402 | -DIRPW | Direction from which primary waves are moving (wrt North) | degree |
| 193 | 403 | -PERSW | Secondary wave period | sec |
| 194 | 404 | -DIRSW | Direction from which secondary waves are moving (wrt North) | degree |
| 195 | 405 | -WCAPS | White cap coverage | percent |

Notes:

* Abbreviations are 6 characters. A dash (-) is used to indicate a blank when printed.

** These data types do not use the standardized ON84 identification scheme and may have been stored in non-standard units. Contact NMC/CAC/AIB for further information.

@ 273.15 degrees has been added to the original data values.

@@ Has been stored in units of 100s of feet.

wrt means "with respect to"

Table 2 - T
TIME MARKER

(4 bits)

| T (Dec) | Meaning | F1 (*) | F2 (*) |
|---|---|---|---|
| 0 | Instantaneous field. E.g., 500-hPa height forecast: Q<br>F1 = 0 denotes an analysis unless M set equal to 8, 9, or 10. ( See Table 3.) | Fcst time of Q | 0 |
| 1 | Field formed from 2 fields whose valid times are equal but whose forecast times may or may not be equal. E.g., difference between 2 analyses (times equal), or difference between a forecast and the verifying analysis (times unequal): Q2 - Q1 | Fcst time of Q2 | Fcst time of Q2 minus fcst time of Q1 |
| 2 | Field formed from 2 fields whose forecast times are equal but whose valid times are unequal. E.g., a tendency field formed by differencing 2 analyses which are 12 hours apart: Q2 - Q1 | Fcst time of Q1 and Q2 | Valid time of Q2 minus valid time of Q1 |
| 3 | Field formed from 2 fields whose initial times are equal but whose forecast times are unequal. E.g., a forecast tendency field: Q2 - Q1 | Fcst time of Q2 | Fcst time of Q2 minus fcst time of Q1 |
| 4 | Field of normal values averaged over a number of days, where F1 = number of days and F2 = 0, or averaged over a number of years, where F1 = 0 and F2 = number of years. | Days used in average<br>-or-<br>0 | 0<br>-or-<br>Years used in average |
| 5 | Non-instantaneous field. E.g., a field of forecast probability of precipitation during some time period. | Fcst time at end of period | Fcst time at end of period minus fcst time at beginning. |

| T (Dec) | Meaning | F1 (*) | F2 (*) |
|---|---|---|---|
| 6 | Field of time-averaged values. E.g., a 5-day height mean: (Q1+Q2+Q3+Q4+Q5)/5 with F1 the fcst time of Q1 in half days and F2 = 8 half days. | Fcst time of bgng of period in half days, high-order bit on if negative | Length of period in half days |
| 7 | Field of differences between 2 fields of time-averaged values of type T=6. E.g., the difference of two 5-day height means Q2 - Q1, Q2 centered at D+8, Q1 centered at D+3. | Fcst time of Q2 in half days | Fcst time of Q2 minus fcst time of Q1 in half days |
| 10 | Same meaning as case T=2 except F1 and F2 are in days. | | |

(*) F1 and F2 are in hours unless N=15 (Table 5) or unless half days, days or years are specified.

Table 3 - M

LEVEL DIFFERENCE AND INITIALIZATION MARKER

(4 bits)

| M | Value |
|---|---|
| 0 | Indicates S2 and L2 are not applicable. (In this case S2 = L2 = 0) |
| 1 | Indicates a field formed by taking the value of Q at S1 minus the value of Q at S2. |
| 2 | Indicates a field of Q for a layer bounded by S1 and S2. |
| 3 - 7 | Available |
| 8 - 10 | Same meanings as 0-2 above except the field has been initialized by a model identified by the Generating Code in Table 10. Such initialized fields are often referred to as "00-hour forecasts". |
| 11 - 15 | Available |

Table 4 - X

EXCEPTION MARKER

(8 bits)

| X | Value |
|---|---|
| 0 | Indicates the date/time of the field is the same as the date/time of the file in which the field is stored. |
| 1 | Indicates the date/time of the field is 6 hours prior to the date/time of the file in which the field is stored. |
| 2 | Indicates the date/time of the field is 12 hours prior to the date/time of the file in which the field is stored. |
| ... | ... |
| n | Indicates the date/time of the field is 6*n hours prior to the date/time of the file which the field is stored. |
| ... | ... |
| 80 | Special use marker to indicate a field produced with spectral wave truncation. |
| 100 | Field formed from combination of NMC and ECMWF fields. |
| 101 | Field formed from combination of NMC and UKMET fields. |
| 255 | Not applicable. |

Table 5 - N

MISCELLANEOUS MARKER

(4 bits)

| N | Value |
|---|---|
| 0 | None of the following |
| 1 | Spectral specification |
| 2 | Zonal coefficient |
| 3 | Spectral amplitude |
| 4 | Spectral phase angle |
| 5 | Summation over wave numbers 0 - 5 |
| ... | ... |
| 15 | F1 and/or F2 are in half days |

Table 6 - CM and CD

CLIMATOLOGY MARKERS

(8 bits each)

| CM | Month-Hour |
|---|---|
| 00 | Not applicable |
| 01 | JAN - 0000 UTC |
| 02 | FEB - 0000 UTC |
| | ... |
| 12 | DEC - 0000 UTC |
| 13 | JAN - 1200 UTC |
| 14 | FEB - 1200 UTC |
| | ... |
| 24 | DEC - 1200 UTC |

| CD | Day of Month |
|---|---|
| 00 | Not applicable |
| 01 | 1st day of month |
| 02 | 2nd day of month |
| | ... |
| 31 | 31st day of month |

Table 7 - K

GRID TYPE
("A" indicates a currently active Grid Type)

| K Hex | Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 0 | 0 A | 1977-point N. Hemisphere polar stereographic grid (octagon) oriented 80W; Pole at (24,26). | 381 km at 60N |
| 1 | 1 A | 1679-point (73x23) Mercator grid with (1,1) at (0W,48.09S), (73,23) at (0W, 48.09N); I increasing eastward, Equator at J=12. | 5 degs of longitude |
| 2 | 2 | 1752-point (73x24) Mercator grid for latitudes 49.73S to 49.73N. | 5 degs of longitude |
| 3 | 3 | 3021-point (53x57) N. Hemisphere polar stereographic grid oriented 80W; Pole (27,29). | 381 km at 60N |
| 4 | 4 A | 259920-point (720x361) global lon/lat grid;(1,1) at 0E, 90N; matrix layout; prime meridian not duplicated | 0.5 deg |
| 5 | 5 A | 3021-point (53x57) N. Hemisphere polar stereographic grid oriented 105W; Pole at (27,49). | 190.5 km at 60N |
| 6 | 6 | 1977-point octagonal subset of grid type 5; Pole at (24,46). | 190.5 km at 60N |
| 7 | 7 | 2329-point N. Hemisphere polar stereographic grid (octagon) oriented 80W. | 381 km at 60N |
| 8 | 8 | 5104-point (116x44) Mercator grid with (1,1) at (3.1035E,48.67S) and (116,44) at (0W,61.05N); I increasing eastward, Equator at J=19. | 3.1035 degs of longitude |
| 9 | 9 A | Station grid (US and Canada) for TDL wind, cloud, flight weather, sunshine, dewpoint, temperature, and max/min products. Number of stations varies from product to product, but usually ranges from 143 to over 200. | |
| A | 10 A | Station grid (US cities) for TDL probability of precipitation type (POPT). | |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| B | 11 | 286 US cities for TDL precipitation amount. | |
| C | 12 | 1702-point (74x23) Mercator grid for latitudes 48.09S to 48.09N. | 5 degs of longitude |
| D | 13 | 576-point (36x16) N. Hemisphere longitude/latitude LRPG diamond array--pole stored at top of every 10 degs of longitude--for latitudes 15S to 90N. | |
| E | 14 | 108 U.S. stations for TDL max/min temps. | |
| F | 15 | 40 U.S. stations for TDL max/min temps. | |
| 10 | 16 | 1560-point (39x40) N. Hemisphere polar stereographic grid (Eastern U.S.) oriented 80W. | 95.25 km at 60N |
| 11 | 17 A | 221-point (17x13) N. Hemisphere polar stereographic grid oriented 105W; Pole at (7,21). US grid used for TDL trajectory model. | 381 km at 60N |
| 12 | 18 | 4205-point (129x29) lat/lon tropical strip (35S to 35N) (0 - 360E) (1,1) at 35S, 0 deg. (from ECMWF) | 2.5 degs |
| 13 | 19 | 1977-point S. Hemisphere polar stereographic grid (octagon) oriented 100E; Pole at (24,26). | 381 km at 60S |
| 14 | 20 | 2655-point (45x59) Mercator grid for latitudes 30S to 30N. | 1.5 degs of longitude |
| 15 | 21 A | 1387-point (73x19) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N. | 5 degs |
| 16 | 22 A | 1387-point (73x19) S. Hemisphere longitude/latitude grid for latitudes 90S to 0S. | 5 degs |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 17 | 23 | 783-point (29x27) N. Hemisphere polar stereographic grid oriented 105W. US grid is used for NMC/TDL boundary layer model. | 190.5 km at 60N |
| 18 | 24 A | 651-point (31x21) N. Hemisphere polar stereographic grid oriented 98W; Pole at (15,41). US grid is used for TDL probability of precipitation, max/min temperature, dewpoint, surface temperature, and sunshine. | 190.5 km at 60N |
| 19 | 25 | 3021-point (53x57) S. Hemisphere polar stereographic grid oriented 100E; Pole at (27,29). | 381 km at 60S |
| 1A | 26 A | 2385-point (53x45) N. Hemisphere polar stereographic grid oriented 105W; Pole at at (27,49). | 90.5 km 60N |
| 1B | 27 A | 4225-point (65x65) N. Hemisphere polar stereographic grid oriented 80W; Pole at (33,33). | 381 km at 60N |
| 1C | 28 A | 4225-point (65x65) S. Hemisphere polar stereographic grid oriented 100E; Pole at (33,33). | 381 km at 60S |
| 1D | 29 A | 5365-point (145x37) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N). | 2.5 degs |
| 1E | 30 A | 5365-point (145x37) S. Hemisphere longitude/latitude grid for latitudes 90S to 0S; (1,1) at (0E,90S). | 2.5 degs |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 1F | 31 A | 327-point TDL field composed of 4 grids: US, Alaska, Hawaii, and Puerto Rico. The US grid is a 255-point (17x15) N. Hemisphere polar stereographic grid oriented 80W; Pole at (13,22). Alaska grid is a 56-point (7x8) N. Hemisphere polar stereographic grid oriented 80W; pole at (11,8). The Hawaii grid is a 12-point (3x4) N. Hemisphere polar stereographic grid oriented 80W; Pole at (23,7). The Puerto Rico grid is a 4-point (2x2) N. Hemisphere polar stereographic grid oriented 80W; Pole at (-4,23). (These grids are used to archive MRF Model data). | 381 km at 60N |
| 20 | 32 A | 744-point (31x24) N. Hemisphere polar stereographic grid oriented 105W; Pole at (13,42). The TDL grid (US) is used to archive LFM data. | 190.5 km at 60N |
| 21 | 33 A | 8326-point (181x46) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N). | 2 degs |
| 22 | 34 A | 8326-point (181x46) S. Hemisphere longitude/latitude grid for latitudes 90S to 0S; (1,1) at (0E,90S). | 2 degs |
| 23 | 35 | 228 U.S. cities for TDL MOS max/min temperatures. | |
| 24 | 36 A | 1558-point (41x38) N. Hemisphere polar stereographic grid oriented 105W; Pole at (19,42). The TDL grid (N. America) is used to archive LFM and NGM data. | 190.5 km at 60N |
| 25 | 37 | 5365-point (145x37) N. Hemisphere longitude/latitude grid for latitudes 1.25 to 88.75N; (1,1) at (1.25E,1.25N); row 37 is fictitious. | 2.5 degs |
| 26 | 38 | 5365-point (145x37) S. Hemisphere longitude/latitude grid for latitudes 88.75S to 1.25S; (1,2) at (1.25E,88.75S); row 1 is fictitious. | 2.5 degs |

Table 7 - K (cont.)
GRID TYPE

| K Hex | Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 27 | 39 | 8326-point (181x46) N. Hemisphere longitude/latitude grid for latitudes 1N to 89N, (1,1) at (1E,1N); row 46 is fictitious. | 2 degs |
| 28 | 40 | 8326-point (181x46) S. Hemisphere longitude/latitude grid for latitudes 89S to 1S, (1,2) at (1E,89S); row 1 is fictitious. | 2 degs |
| 29 | 41 | 850-point (34x25) N. Hemisphere longitude/latitude grid for latitudes to 46N; (1,1) at (87W,22N). | 1 deg 22N |
| 2A | 42 | available. | |
| 2B | 43 | 4225-point (65x65) N. Hemisphere polar stereographic grid oriented 105W; Pole at (33,33). | 381 km at 60N |
| 2C | 44 | 4225-point (65x65) S. Hemisphere polar stereographic grid oriented 75E; Pole (33,33). | 381 km at 60S |
| 2D | 45 | 2425-point (97x25) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N). | 3.75 degs |
| 2E | 46 | 2425-point (97x25) S. Hemisphere longitude/latitude grid for latitudes 90S to 0N; (1,1) at (0E,90S). | 3.75 degs |
| 2F | 47 A | 10057-point (113x89) N. Hemisphere polar stereographic grid oriented 105W; Pole at (41,161). | 47.625 km at 60N |
| 30 | 48 | 3477-point (61x57) N. Hemisphere polar stereographic grid oriented 105W; Pole at (27,49). | 190.5 km at 60N |
| 31 | 49 | 16641-point (129x129) N. Hemisphere polar stereographic grid oriented 80W; Pole at (65,65). | 190.5 km at 60N |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 32 | 50 | 16641-point (129x129) S. Hemisphere polar stereographic grid oriented 100E; Pole at (65,65). | 190.5 km at 60S |
| 33 | 51 A | 16641-point (129x129) N. Hemisphere polar stereographic grid oriented 105W; Pole at (65,65). | 190.5 km at 60N |
| 34 | 52 | available. | |
| 35 | 53 | 5967-point (117x51) Mercator grid with (1,1) at (0W,61.05S) and (117,51) at (0W,61.05N); I increasing eastward, Equator at J=26. | 3.1035 degs of longitude |
| 36 | 54 A | 1050-point (35x30) N. Hemisphere polar stereographic grid oriented 80W; Pole at (1,75). The TDL grid (eastern US) is used for a boundary layer model. | 95.25 km at 60N |
| 37 | 55 A | 6177-point (87x71) N. Hemisphere polar stereographic grid oriented 105W; Pole at (44,38). (2/3 bedient NH sfc anl) | 254 km at 60N |
| 38 | 56 A | 6177-point (87x71) N. Hemisphere polar stereographic grid oriented 105W; Pole at (40,73). (1/3 bedient NA sfc anl) | 127 km at 60N |
| 39 | 57 | available | |
| 3A | 58 | 100 U.S. cities for 24-hour accumulated precipitation. | |
| 3B | 59 | 5293-point (79x67) subset of grid type 56 (used for LFM-II mountains); Pole at (40,73). | 127 km at 60N |
| 3C | 60 A | 3249-point (57x57) N. Hemisphere polar stereographic grid oriented 105W; Pole at (29,49). | 190.5 km at 60N |
| 3D | 61 A | Spectral coefficients, scalar fields. (961 COMPLEX*8 words). | 30 modes |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 3E | 62 A | Spectral coefficients, U- or V-component fields. (992 COMPLEX*8 words). | 30 modes |
| 3F | 63 A | 1095-point (73x15) longitude/latitude grid for latitudes 35S to 35N; (1,1) at (0,35S) and I increasing eastward. | 5 degs |
| 40 | 64 | 875-point (35x25) longitude/latitude grid; lat: 18.5N to 30.5N, long: 97.5W to 80.5W; Gulf of Mexico wave forecasts. | 0.5 deg |
| 41 | 65 | available | |
| 42 | 66 | 2701-point (73x37) longitude/latitude grid for latitudes 90S to 90N; (1,1) at (0,90S); I increasing eastward. | 5 deg |
| 43 | 67 A | 13689-point (117x117) N.W. Atlantic polar stereographic grid oriented 80W; Pole at (9,317). | 23.8125 km at 60N |
| 44 | 68 A | 13689-point (117x117) Gulf of Mexico polar stereographic grid oriented 105W; Pole at (-35,361). | 23.8125 km at 60N |
| 45 | 69 A | 13689-point (117x117) Gulf of Alaska polar stereographic grid oriented 105W; Pole at (177,209). | 23.8125 km at 60N |
| 46 | 70 A | 13689-point (117x117) Calif. Pacific polar stereographic grid oriented 105W; Pole at (169,285). | 23.8125 km at 60N |
| 47 | 71 A | 13689-point (117x117) Mexican Pacific polar stereographic grid oriented 105W; Pole at (137,377). | 23.8125 km at 60N |
| 48 | 72 | 406-point (29x14) Mercator grid with (1,1) at (170.00E,46.40N) and (29,14) at (120.00W,64.40N). | 2.5 degs of longitude |
| 49 | 73 | 13056-point (128x102) global Gaussian longitude/latitude grid. | R40 trans |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 4A | 74 A | 10800-point (180x60) N. Hemisphere longitude/latitude grid for latitudes 0N to 90N; (1,1) at (0E,0N). | 2.0 deg lon 1.5 deg lat |
| 4B | 75 A | 12321-point (111x111) N. Hemisphere Lambert Conformal grid. No fixed location; used by QLM Hurricane model. | 40 km at 30&60 deg N |
| 4C | 76 A | 12321-point (111x111) S. Hemisphere Lambert Conformal grid. No fixed location; used by QLM Hurricane model. | 40 km at 30&60 deg S |
| 4D | 77 A | 12321-point (111x111) N.& S. Hemisphere Mercator grid. No fixed location; used by QLM Hurricane model. | 40 km at equator |
| 50 | 80 A | 2976-point (62x48) N. Hemisphere polar stereographic grid oriented 105W; Pole at (24.683025,85.27335). (MAPS analysis/forecast grid.) | 80.0 km at 40N |
| 51 | 81 A | 7921-point (89x89) N. Hemisphere polar stereographic grid oriented 80W; pole at (44.5,44.5) | 190.5 km at 60N |
| 52 | 82 | 15372-point (244x63) N. Hemisphere T80 Gaussian transform lat/lon grid | variable |
| 53 | 83 | 15372-point (244x63) S. Hemisphere T80 Gaussian transform lat/lon grid | variable |
| 54 | 84 | 1344-point (42x32) N. Hemisphere polar stereographic grid oriented 105W; Pole at (16.08811,61.33562). (AFOS B03 p-s projection) | 111.0 km at 40N |
| 55 | 85 A | 32400-point (360x90) N. Hemisphere longitude/latitude grid; longitudes: 0.5E to 359.5E (0.5W); latitudes: 0.5N to 89.5N; origin (1,1) at (0.5E,0.5N) | 1 deg |

Table 7 - K (cont.)
GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 56 | 86 A | 32400-point (360x90) S. Hemisphere longitude/latitude grid; longitudes: 0.5E to 359.5E (0.5W); latitudes: 89.5S to 0.5S; origin (1,1) at (0.5E,89.5S) | 1 deg |
| 57 | 87 A | 5022-point (81x62) N. Hemisphere polar stereographic grid oriented 105W. Pole at (31.91,112.53) (60 km at 40N) Used in MAPS/Rapid Update Cycle | 68.153 km at 60N |
| 58 | 88 A | 262144-point (512x512) N. Hemisphere polar stereographic grid oriented 80W. Pole at (257,256) Shared Processing Net. | 47.625 km at 60N |
| 59 | 89 A | 262144-point (512x512) S. Hemisphere polar stereographic grid oriented 100E. Pole at (257,256) Shared Processing Net. | 47.625 km at 60S |
| 5A | 90 A | 12902 point (92x141 semi-staggered) lat. long., rotated such that center located at 52.0N, 111.0W; LL at 37.5W, 35S Unfilled E grid for 80 km ETA model | lat. 14/26 deg lon. 15/26 deg |
| 5B | 91 A | 25803 point (183x141) lat. long., rotated such that center located at 52.0N, 111.0W; LL at 37.5W,35S Filled E grid for 80 km ETA model | lat. 14/26 deg lon. 15/26 deg |
| 5C | 92 A | 24162 point (127x191 semi-staggered) lat. long., rotated such that center located at 41.0N, 97.0W; LL at 35W,25S Unfilled E grid for 40 km ETA model | lat. 15/57 deg lon. 5/18 deg |
| 5D | 93 A | 48323 point (253x191) lat. long., rotated such that center located at 41.0N, 97.0W; LL at 35W ,25S Filled E grid for 40 km ETA model | lat. 15/57 deg lon. 5/18 deg |
| 62 | 98 A | 18048-point (192x94) global T62 spectral Gaussian transform grid. Matrix layout. Origin at 0.0E and Gaussian lat 88.542N 192 columns (long.); 94 rows (lat.) | variable |

## Table 7 - K (cont.)
## GRID TYPE

| K Hex | K Dec | GRID TYPE | Grid Increment |
|---|---|---|---|
| 64 | 100 A | 6889-point (83x83) N. Hemisphere polar stereographic grid oriented 105W; Pole at (40.5,88.5). (NGM Original C Grid ) | 91.452 km at 60N |
| 65 | 101 A | 10283-point (113x91) N. Hemisphere stereographic grid oriented 105W; Pole at (58.5,92.5). (NGM Expanded C Grid ) | 91.452 km at 60N |
| 66 | 102 A | 14375-point (115x125) N. Hemisphere stereographic grid oriented 105W; Pole at (13,241). (HPB precip. analysis) | 31.75 km at 60N |
| 67 | 103 A | 3640-point (65x56) N. Hemisphere polar stereographic grid oriented 105W; Pole at (25.5,84.5) (Used by ARL) | 91.452 km at 60N |
| 68 | 104 A | 16170-point (147x110) N.Hemisphere polar stereographic grid oriented 105W; pole at (75.5,109.5). (NGM Super C grid) | 90.75464 km at 60N |
| 69 | 105 A | 6889-point (83x83) N.Hemisphere polar stereographic grid oriented 105W; pole at (40.5,88.5). (Subset of NGM Super C grid) | 90.75464 km at 60N |
| 6A | 106 A | 19305 point (165x117) N. Hemisphere stereographic grid oriented 105W; pole at (80,176) Hi res ETA (2 x resolution of Super C) | 45.37732 km at 60N |
| 6B | 107 A | 11040 point (120x92) N. Hemisphere stereographic grid oriented 105W; pole at (46,167) subset of Hi res ETA; for ETA & MAPS/RUC | 45.37732 km at 60N |
| 7E | 126 A | 72960-point (384x190) global T126 spectral Gaussian transform grid. Matrix layout. Origin at 0.0E and Gaussian lat 89.277N 384 columns (long.); 190 rows (lat.) | variable |
| D6 | 214 A | 6693-point (97x69) N. Hemisphere polar stereographic grid oriented 150W; Pole at (49,101); AWIPS Alaskan area. | 47.625 km at 60N |
| FF | 255 | Not applicable. | |

## Table 8 - KS

## DERIVATION MARKER

(8 bits)

| KS | Derivation method |
|---|---|
| 0 | None of the following |
| 1 | Hough spectral method |
| 2 | Field formed by subtracting a climatological normal from each data value; e.g., a field of departure from normal heights. |

## Table 9 - R

## RUN MARKER

(8 bits)

| R | Run |
|---|---|
| 0 | Early run (ERL) |
| 1 | Initializing run (NMC) |
| 2 | Regional run (RGL) |
| 3 | Aviation run (AVN) |
| 4 | Medium Range Forecast run (MRF) |
| 5 | Final operational run in a given observational cycle (FNL) |
| 6 | Hurricane Run (HCN) |
| 7 | Rapid Update Cycle (RUC) |
| 15 | Runs from non-NMC networks |
| 255 | Not applicable |

Table 10 - G

GENERATING PROGRAM

(8 bits)
"A" indicates a currently active Generating Program

| G Hex | Dec | Name of program generating data | Map Label |
|---|---|---|---|
| 0 | 0 | Objective analysis (Cressman octagon) | |
| 1 | 1 A | Barotropic fcst model | BATRO |
| 2 | 2 | Mesh model 1958 | |
| 3 | 3 | Mesh model 1964 (imprv. terr.) | |
| 4 | 4 | Reed 1000-hPa fcst model | |
| 5 | 5 | 3-level baroclinic fcst model | |
| 6 | 6 | 4-level baroclinic fcst model | |
| 7 | 7 | 4-layer Primitive Equation model (PE) | |
| 8 | 8 | 6-layer PE model | |
| 9 | 9 A | Maximum and minimum temperature fcst | |
| A | 10 A | Sea height and swell fcst | NOWAV |
| B | 11 | Tropical analysis | |
| C | 12 | Tropical fcst | |
| D | 13 | Bat analysis | |
| E | 14 | Tropical fcst | |
| F | 15 | Tropical fcst with satellite modification | |
| 10 | 16 | Sub-synoptic advection model | |
| 11 | 17 | Compute long wave components | |
| 12 | 18 A | Trajectory forecast | |
| 13 | 19 A | Successive Correction Method analysis | SCM |
| 14 | 20 | Limited-area successive correction method | LFM1 |
| 15 | 21 | Perfect prog precipitation fcst | |
| 16 | 22 A | Hough analysis | HOUGH |
| 17 | 23 | Eddy analysis and SANBAR fcst (NHC Miami) | |
| 18 | 24 | NWRC/NCAR climatology data | |
| 19 | 25 A | Snow cover | SNOW |
| 1A | 26 | Planetary boundary layer analysis and fcst | |
| 1B | 27 | Extended fcst data processor | |
| 1C | 28 | PE and trajectory model output statistics | |
| 1D | 29 | 9-layer global PE model (5-deg mesh) | |
| 1E | 30 | 9-layer N.H. PE model (2.5-deg mesh) | |
| 1F | 31 | 6-layer PE model (360/195 version) | 6LPE |
| 20 | 32 | Sea surface temp., satellite derived | |
| 21 | 33 | Land shelter temperature analysis | |
| 22 | 34 | Energy statistics code | |
| 23 | 35 | 9-layer global PE model (2.5-deg mesh) | |
| 24 | 36 | As above except used for 6-hour cycle | |

Table 10 Generating Program (cont.)

| G Hex | Dec | Name of program generating data | Map Label |
|---|---|---|---|
| 25 | 37 | 3-layer global PE model | |
| 26 | 38 | 7-layer PE Hemis. fine mesh model, 190.5 km | 7LPE |
| 27 | 39 A | Nested Grid Model | NGM |
| 28 | 40 | 9-layer N. H. PE model (2-deg mesh) | |
| 29 | 41 | LFM with 127-km grid increment | LFM2 |
| 2A | 42 | 7-layer PE model (381 km grid) | 7LCM |
| 2B | 43 A | Global Optimum Interpolation analysis | GOI |
| 2C | 44 A | Sea surface temperature analysis | NOW |
| 2D | 45 | Spectral Model Global 24-mode 12-layer | SMG2C |
| 2E | 46 | Spectral Model Global 30-mode 12-layer | SMG3C |
| 2F | 47 | Spectral Model Hemis. 24-mode-12 layer | SMH2C |
| 30 | 48 | Spectral model Hemis. 30-mode-12 layer | SMH3C |
| 31 | 49 | Ozone Analysis TIROS Operational | TOVS |
| 32 | 50 | Spectral model Global 24-mode 6-layer | SMG26 |
| 33 | 51 | Spectral model Global 30-mode 6-layer | SMG36 |
| 34 | 52 | Ozone Analysis Nimbus 7 | SBUV |
| 35 | 53 A | LFM with Fourth-Order differencing | LFM |
| 36 | 54 | Spectral model Hemis. 24-mode 6-layer | SMH26 |
| 37 | 55 A | N. American sea level pressure analysis | NMSFC |
| 38 | 56 A | N. H. sea level pressure analysis | NHSFC |
| 39 | 57 A | European Center for Medium-range Wea. Fcst. | ECMWF |
| 3A | 58 | Fleet Numerical Oceanography Center | FNOC |
| 3B | 59 | Air Force Global Weather Central | AFGWC |
| 3C | 60 | NWS Central Region | CRGN |
| 3D | 61 | NWS Western Region | WRGN |
| 3E | 62 | NWS Eastern Region | ERGN |
| 3F | 63 A | Spectral model Global 40-mode 12-layer | SMG4C |
| 40 | 64 A | Regional Optimum Interpolation Analysis | ROI |
| 41 | 65 A | Spectral model Global 40-mode 18-layer | SMG4I |
| 42 | 66 A | U.K. Meteorological Office | UKMET |
| 43 | 67 A | Statistical correction by linear regression | SCLR |
| 44 | 68 | 10-layer hurricane model | HCN |
| 45 | 69 A | T80 L18 Spectral Forecast Model | MRF |
| 46 | 70 A | Quasi-Lagrangian Hurricane Model | QLM |
| 47 | 71 A | Statistical Blending (MRFG) | SBLND |
| 48 | 72 A | Isentropic Analysis | ISENA |
| 49 | 73 A | Statistical Fog & Visibility (MPB) | SFVSB |
| 4A | 74 A | Gulf of Mexico Wind/Wave | GMEXW |
| 4B | 75 A | Gulf of Alaska Wind/Wave | GAKWV |
| 4C | 76 A | Bias Corrected MRF | MRFBC |
| 4D | 77 A | Japanese Meteorological Agency | JMET |
| 4E | 78 A | T126 L28 Spectral Forecast Model | SM126 |

Table 10 Generating Program (cont.)

| G Hex | Dec | Name of program generating data | Map Label |
|---|---|---|---|
| 4F | 79 A | Backup from Earlier Run | BCKUP |
| 50 | 80 A | T62 L18 Spectral Forecast Model | SMT62 |
| 51 | 81 A | Spectral Statistical Interpolation Analysis | SSI |
| 53 | 83 A | ETA Model - 80 km version | ETA80 |
| 54 | 84 A | ETA Model - 40 km version | ETA40 |
| 55 | 85 A | ETA Model - 30 km version | ETA30 |
| 56 | 86 A | RUC/MAPS Model, from Forecast Systems Lab (Isentropic; scale: 60km at 40N) | RUC60 |
| 57 | 87 A | Ensemble Forecasts (CAC) | ENSMB |
| 58 | 88 A | Wave model with additional physics (MPB) | PWAV |

Table 11

HEXADECIMAL EQUIVALENTS FOR FREQUENTLY USED VALUES OF C

(Coding of L)

| Decimal | Hexadecimal |
|---|---|
| 10000 | 02710 |
| 16667 | 04116 |
| 15000 | 03A98 |
| 15240 | 03B88 |
| 18290 | 04772 |
| 20000 | 04E20 |
| 21340 | 0535C |
| 25000 | 061A8 |
| 27315 | 06AB3 |
| 27430 | 06B26 |
| 30000 | 07530 |
| 30480 | 07710 |
| 33333 | 08235 |
| 35000 | 088B8 |
| 36580 | 08EE4 |
| 40000 | 09C40 |
| 41667 | 0A2C3 |
| 42670 | 0A6AE |
| 45000 | 0AFC8 |
| 50000 | 0C350 |
| 55000 | 0D6D8 |
| 58333 | 0E3DD |
| 60000 | 0EA60 |
| 65000 | 0FDE8 |
| 66667 | 1046B |
| 70000 | 11170 |
| 75000 | 124F8 |
| 80000 | 13880 |
| 83333 | 14585 |
| 85000 | 14C08 |
| 90000 | 15F90 |
| 91400 | 16508 |
| 91667 | 16613 |
| 95000 | 17318 |
| 99000 | 182B8 |

Table 12

EXAMPLES OF IDENTIFIER WORDS FOR COMMON FIELDS

(1) 1000-hPa height analysis for N.H. (grid type 27):

00100800 00271081 00000000 00000000 0000001B

(2) 500-hPa height analysis for N.H. (grid type 27):

00100800 00C35082 00000000 00000000 0000001B

(3) 500-hPa temperature analysis for N.H. (grid type 27):

01000800 00C35082 00000000 00000000 0000001B

(4) 500-hPa 12-hour height forecast for LFM (grid type 26):

0010080C 00C35082 00000000 00000000 0000001A

(5) 12-hour forecast of potential temperature for the boundary layer, expressed in sigma coordinates, for the N.H. 2.5 long/lat (grid type 29):

0130900C 00000000 20009000 00271084 0000001D

(6) 100-hPa forecast height tendency, for 6 to 18 hours after an initial time, which is 12 hours prior to the date/time of the file (grid type 27):

00100812 30271082 0020000C 00000000 0000001B

(7) Precipitation at the surface which is forecast to be accumulated between 24 and 30 hours after the initial time (grid type 27):

05A0811E 30000000 00000006 00000000 0000001B

Table 13 - P

PACKING MARKER

(4 bits)

| P | Value |
|---|---|
| 0 | 16 bits used for packing |
| 2 | 2 bits used for packing |
| 4 | 4 bits used for packing |
| 8 | 8 bits used for packing |
| 12 | 12 bits used for packing |

```
               Figure 1 - NMC Format for Packed Data Fields
W                  Upper left: Table reference, if any
o                  Upper right: Field size in bits
r        Bit . . . .
d  0      3 4     7 8    11 12   15 16          23 24         31
-----------------------------------------------------------------
  |1                    12|1                    12|            8|
1 | Q  Data type          | S1  Type of surface 1 | F1  Time 1  |
-----------------------------------------------------------------
  |2  T  4|      Numerical value of           20|              8|
2 |Marker | C1   Surface 1 = C1 * 10**E1        | E1            |
-----------------------------------------------------------------
  |3  M  4|4 Exception  8|1                   12|              8|
3 |Marker | X Marker     | S2  Type of surface 2 | F2  Time 2   |
-----------------------------------------------------------------
  |5  N  4|      Numerical value of           20|              8|
4 |Marker | C2   Surface 2 = C2 * 10**E2        | E2            |
-----------------------------------------------------------------
  |6  Climat day 8|6  Climat   8|8  Derivation 8|7             8|
5 | CD of month   | CM Month Hour | KS  Method   | K  Grid type |
-----------------------------------------------------------------
  | =0,1 4|# of  4| Internal I/O 8|    For internal use      16|
6 |1st GES|add.rec|   use only    | NW  by I/O routines only    |
-----------------------------------------------------------------
  |               8|             8|              8|   Initial  8|
7 | YY  Year       | MM  Month    | DD  Day       | II Hour     |
-----------------------------------------------------------------
  |9   Run       8|10 Generating 8|                           16|
8 | R  Marker     | G  Program    | J  Number of data points    |
-----------------------------------------------------------------
  |   Number of bytes           16|   Exclusive OR            16|
9 | B  in Record                  | Z  Checksum                 |
-----------------------------------------------------------------
1 |                                                           32|
0 | A  Reference value, REAL*4 floating point                   |
-----------------------------------------------------------------
1 | 13 P 4|                     12|   Scaling value           16|
1 | Marker|      Reserved         | n  (INTEGER*2)              |
-----------------------------------------------------------------
1 |                                                           32|
2 | Reserved                                                    |
-----------------------------------------------------------------
1 |                             16|                           16|
3 | Data point 1                  | Data point 2                |
-----------------------------------------------------------------
1 |                             16|                           16|
4 | Data point 3                  | Data point 4                |
-----------------------------------------------------------------
                                etc.
```

Notes: next page...

In word 6, bits 0-3 indicate source of GES ... 0 = AVN run 1 = FNL run

In word 6, bits 4-7 are used to accommodate logical records that exceed the maximum physical record length set when the file was allocated. Such records are split into additional physical records. You must account for those additional records in the original allocation of the data set.